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SEINÄJOEN AMMATTIKORKEAKOULU  
SEINÄJOKI UNIVERSITY OF APPLIED SCIENCES

Sari-Maarit Peltola, Seliina Päällysaho & Sirkku Uusimäki  
(eds.)

Proceedings of the ERIAFF conference  
“Sustainable Food Systems:  
Multi-actor Co-operation to Foster  
New Competitiveness of Europe”

Sari-Maarit Peltola, Seliina Päällysaho &  
Sirkku Uusimäki (eds.)

# Proceedings of the ERIAFF conference ‘Sustainable Food Systems: Multi-actor Co-operation to Foster New Competitiveness of Europe’



Seinäjoki 2014

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## FOREWORD

### South Ostrobothnia – Original Culture, Rich History, and Entrepreneurial Spirit

The region of South Ostrobothnia is one of the successful regions in Finland. Through cooperation between its municipalities and cities, as well as between different interest groups, the region has entered a growth path. The region is known for its agriculture and entrepreneurial activity. Despite of its cold climate and short summers, the region of South Ostrobothnia is called the Food Province of Finland.

The main elements for creating a strong base for the food sector in the region of South Ostrobothnia are expertise in the field of sustainable and effective solutions for food systems and bio-economy, intelligent and energy-efficient system innovations, and the renewing production of services and events. The region is actively working for sustainable innovations in agriculture as well as in the food and forestry sectors. The emphasis is on the entire agro-food production chain, including nutrition and human well-being as a whole.

The world is changing, and European regions are facing various challenges. However, we are sure that international multi-actor co-operation can open new opportunities and foster new competitiveness for Europe. We see the ERIAFF network as an important element for developing international co-operation, sharing knowledge and creating more sustainable solutions for food systems in the future. The development of sustainable food system concerns the entire European Union and its citizens. For this, we need cross-border co-operation between regions from south to north and from east to west.

Asko Peltola  
Regional Mayor  
Regional Council of South Ostrobothnia

Tapio Varmola  
President  
Seinäjoki University of Applied Sciences

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## INTRODUCTION

The ERIAFF Conference was organised by a consortium of partners from the Satakunta and South Ostrobothnia regions together with the ERIAFF network. The event was held on June 10–12, 2014 and took place in the heart of the South Ostrobothnia Region, Seinäjoki, Finland.

The ERIAFF network (European Regions for Innovation in Agriculture, Food and Forestry) focuses on moving the regions towards a better coordinated multi-actor co-operation between its' regions within the agriculture, food and forestry sectors. Networks' main task is to create innovative actions for the growth and sustainability of the sector. At the moment there are 30 member regions, 19 observing regions participating in the actions of the ERIAFF network.

The focus of the ERIAFF Conference 2014 was to recognize and have a strategic discussion on the common innovation and research priorities in the field of food systems in the future, both on the national and regional as well as European level. The ERIAFF Conference also aimed to connect stakeholders from various sectors around project, research and business ideas and to encourage SMEs to take part in the international activities in the sustainable food systems. The selected theme stressed that innovation should happen all along the whole Agri-food Chain.

With its broad program the Conference was a mix of exchanging knowledge, creating innovative partnerships, networking with international organisations and participants. The conference took a foresight to the future and aimed to have an input to the European, national and regional policies in order to create a cooperation that meets the actual, bottom-up needs that arise from the various actors in the chain of sustainable food systems.

ERIAFF Conference created an essential link between international and national co-operation. Seinäjoki's 'Green Creative Garden – sustainable and efficient food system solutions' is part of the national Innovative Cities (INKA) program for bioeconomy in association with the urban areas of Joensuu (coordination responsibility) and Jyväskylä. The goal of the programme is to develop Seinäjoki into an internationally known breeding ground for the development of food systems and thus make Finnish companies into the forerunners of this industry, that is, providers of global food system know-how and solutions with high added value. The INKA-program began in early 2014, and it is managed by the Finnish Funding Agency for Innovation (Tekes).

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# Small Smart Farm: Support Systems to Small Holdings and Family Farms in Food Production and Land Care

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Tuscany Region Italy

## 1 INTRODUCTION

Small Holdings and Family Farms can be considered a significant model of sustainable food production system and landcare. During periods of diffuse economic crisis, due to their intrinsic capacity to quickly reorganize themselves, small cooperative Family Farms offer better resilience and better social inclusivity than conventional farm enterprises. To be sustainable and competitive in the market, these rural activities require, on other hand, the same tools and resources as the bigger, better structured farms. Reliable, agile, productive and profitable management approaches should be developed in order to enhance working practices; this can be done by employing new techniques and technologies that only an innovative services system could offer. Ancillary regional service platforms could play an essential role in providing integrated communication systems for Smart Intelligent Agriculture and Precision Farming on small scale farms too. Monitoring, Decision Support Systems and Automation could be provided by these new Smart Technologies and we can today avails of the natural know how of the emerging young generation; so, as a consequence, agriculture could become an attractive and profitable employment for the next generation.

In many European regions, that are aware of the importance of elements described above, are developing territorial platforms to better manage the mentioned available high technologies. The goal is to help farms, and especially SHF (small holdings) and FF (family farms) to use new smart technologies to their advantage. AgriSmaRT, following these principles, is a developing case in the Tuscany area and nowadays is applying in winery and mountain farm production. AgriSmaRT is a multi actor consortium that includes organizations of many types (Research Centers, SMEs, Farmers and others) gathering multiple competences, ranging from farming to earth observation. It is characterized by the use of Smart Technologies by which manage productive farming resources: soil, water and air. Other aims are to create optimum conditions for maintaining slope stability, best water content maintenance, best biological a biochemical

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activity on soil, optimum nutrient efficiency; best crop health in order to obtain the best assumption of nutrients, micronutrients, chemicals; best biodiversity conservation. As a result of this more profitable and sustainable process, FFs could produce more agricultural products and food, of higher quality and with less inputs.

Smart Small Holdings and Family Farm have also properties to better fit the increasing demands in landcare ([www.landcareonline.com.au](http://www.landcareonline.com.au), [www.landcareresearch.co.nz](http://www.landcareresearch.co.nz)) and in consumer participation to management choices (<http://willvoteforfood.com>). Family Farms, Youth, High technologies achieve the concept of GLOCAL farm production: rootedness and global projected.

## 2 THE ROLE OF SMALL HOLDINGS AND FAMILY FARMS AND INHERENT PROBLEMS

Family farming is the main form of agriculture in the European Union and worldwide. There are over 400 million family farms in the world – in Europe we have 12 million such farms, which contribute enormously to rural communities and to the Italian economy. The challenge of feeding a growing world population by producing food in a sustainable way is enormous. Farmers are being asked to produce more, with less use of inputs. They are being asked to manage the landscape and environment with ever-changing demands and rules (<http://www.eppgroup.eu>). Taking care of the land starts with taking care of the soil, the fundamental resource in any land-based agricultural system. An increasing number of farmers, natural resource professionals and scientists are focusing, for example, on treating soil as a long-term investment. They are working to implement management practices and cropping systems that support and enhance soil biology as the primary means of restoring the soil to a healthy functional state. They are proving that there is a need to test and implement practical and profitable ways to enhance soil health while meeting our economic and quality-of-life goals as individuals and as communities. (Land Stewardship project).

Smallholdings (SHF) and Family Farms (FF) are both a strength and a weakness for rural productive activities in Italy. In our national agricultural profile ancient forms of farming structures together with the high variability of orographic areas (see the multitude of valleys different and often isolated) have induced a high conservative status of farming.

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	Helpful to achieve the objective	Harmful to achieve the objective
Internal Origin	<b>Strengths</b> <ul style="list-style-type: none"> <li>→ resilience</li> <li>→ land care</li> <li>→ typical product</li> <li>→ renewed interest of young generation</li> <li>→ ...</li> </ul>	<b>Weaknesses</b> <ul style="list-style-type: none"> <li>→ very small scale 1 MHa 1Mfarms olive oil farms 1 700 kHa on 700 kfarms winery</li> <li>→ poor knowhow: WASTE OF...!!!</li> <li>→ conservatively closed</li> <li>→ old age (average 69 years old)</li> <li>→ poor financial power</li> <li>→ ...</li> </ul>
External Origin	<b>Opportunities</b> <ul style="list-style-type: none"> <li>→ natural smart know-how of the new generation</li> <li>→ citizen need of 'urban farms'</li> <li>→ to ways inclusion process</li> <li>→ territorial integration SHFF, pilot farms, SME, RES, schools</li> <li>→ EU pushing !!!!</li> <li>→ ...</li> </ul>	<b>Threats</b> <ul style="list-style-type: none"> <li>→ orographic and structural difficulties</li> <li>→ lack on a specific small scale farm mechanization</li> <li>→ innovation divide</li> <li>→ research sectors division &amp; simplification of the lateral sectors</li> <li>→ ...</li> </ul>

Figure 1. SWAT ANALYSIS on Small Holdings Family Farms in Italy.

Figure 1 shows an overview of problems and opportunities related to sustaining SHF and FF against the risk of abandonment of agricultural land and activities. There are 5 major harmful factors. Firstly the very small scale of farms, which are on average 1–2 hectares. Secondly poor knowhow, which is related to wasteful use and unprofitability of adopted resources, for example small farms use three times the required amount of inputs (seed, chemicals, labour) while, at the same time, obtaining lower yields in comparison with rational farming. Another factor is the average age of farmers (69 y.o.) and a conservatively closed mentality. Last but not least, is the limited financial power of SHFs and FFs.. In addition, external threats are due to: orographic and structural difficulties; the lack of specific small scale farm mechanization; the widely recognized innovation divide. But also important and detrimental it is the division of the research institution that have assumed self-sufficiency and tendency to disqualify the importance of complementary sectors

Researchers found farmers used up to three times the required amount of nitrogen fertilizer, bringing no increase in their harvests, but resulting in 20 to 50% of the nitrogen applied leaking into the air and polluting the groundwater. (Raworth 2012).

Small Farms have effectively remained unaffected by innovation since the beginning of modern technological development: the history of farm machinery clearly reflects how great importance has been given to big size machinery such as the West (American) extensive farming model and poor relevance to the East Asiatic labour intensive model in which small size machinery has been widely developed for village or family farms. Moreover, family farms have been frequently characterized by poor know how and poor resources.

Lack of appropriate know how it is due mainly to the general simplification in farming, introduced since the decades after World War II, by the availability of basic strong effective inputs (chemicals, irrigation, hard mechanization, genetics). Nowadays, this unsustainable productive model requires responsible and appropriate know how on manage farming activities that can avail of Precision Farming techniques. But this implies high investments in equipment, tools, logistics and services that are not economically sustainable from a single farm especially SHF and FF.

The care and support to FF an SHF it is important for many reasons: their resilience in food security and job retention, the increasing need for land management especially in hilly and mountainous areas in order to avoid the risk of natural disasters, for example landslides; the great demand for quality food and typical products; the growing interest in rural activities by young people.. Further reasons related to the current opportunities are: the emerging need for 'urban farms' as a way for citizens to be involved in educational activities related to agriculture.

Significant opportunities can be offered by harnessing the know-how of young people relating to the globally developing Smart Technologies. Enhancement of SHFs and FFs moves indeed through the replacement of the old generation, with the young generation which has the know how to understand and use the new management, logistic and technological availabilities.

A potential factor is the cooperation with services consortia that can create an integrated system, in which SHFs, FFs, pilot farms, SMEs, research and educational institutes, can integrate services and resources within a specific area, with the goal of creating a profitable, competitive, sustainable GLOBAL 'international & local based' enterprise.

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### 3 FROM GREEN REVOLUTION TO SMART AGRICULTURE

In the XX century after the World War II the 'green revolution' replaced the 'industrial revolution' of the previous century. It defined simple strong effective factors to enhance food security: 1 chemical input, 2 mechanization, 3 irrigation and 4 genetic enhancement of crops.

The intensive and often inappropriate use of these factors have created serious environmental problems for the global systems of soil, water and air.

In 2003 at the Georgofili Accademia in Florence it was explained:

*'The farm production system needs to rediscover, design and manage a technical-technological system truly compatible with all production, environmental and territorial factors. The development of operational tools is now addressed to information-technology and the capitalization of the knowledge and skills that together with simpler tools were part of rural autarchy – so sustainable – culture. ...the knowledge of the different characteristics in the different areas of land, the knowledge of climatic and agronomic factors implemented with careful daily observation skills and a historicity of events transmitted orally generation by generation were used to create a business model that we would now like to recreate using modern technologies... traditional farming not in a few acres but in hundreds of hectares.'*

The increasing holistic consciousness of the complex biosystem in which rural activities take place has spurred the developing high technological sector of research to offer solutions to better monitor biological, environmental, operative, logistic, economic factors in the whole farm production system, as well as to model the behavior of the different natural and biological factors and, by Decision Support Systems, to act a management more appropriate to the single site specific condition. At the end of the '90s it was called Precision Farming. Over the last decade several research projects have been conducted in order to focus on individual aspects of each branch of agricultural science.

Technological innovations have developed to such an extent that they can offer a continuous supply of new tools for site specific monitoring, mapping, decision making systems, prescription and driving operations also by automation and robot modules.

Precision Farming currently offers a wide variety of technologies and techniques for:

- Food security (where, how much, how to manage it, how to increase it, how to make it profitable [i.e. auto-steer gives a profit of +10%];
- Water availability 'rates of water extraction for irrigation are exceeding rates of many places';
- Soil quality 'soil quality is a critical factor globally' [i.e. erosion, salinization];
- Land availability 'the global crop land availability is in decline';
- Pesticide/herbicide waste and resistance 'growing number of cases of herbicide resistance' but more increasing technologies to detect disease [i.e. the scab disease];
- Energy cost and availability 'energy demand ... could double between now and 2050'
- PA increases yield by 16% reduces fertilizer input -5%, herbicide -65%, fuel -27% (Jensen et al 2012);
- Environmental protection: 'many of the current approaches will continue to degrade the environment and compromise the world's capacity to produce food in the future'

Precision agriculture techniques, developed by the researcher of all international institutions, are nowadays a huge universe of different heterogeneous technical solutions for the several factors to be managed in the farming process. The current main problem it is to integrate these very important tools in a **coordinated efficient, productive and profitable system**. Multiactor territorial/ regional services platforms could create this integration and offer to all farms, even single FF and SHF, correlated data to manage the complexity of rural productive activities.

## 4 CLOSING THE INNOVATION DIVIDE VIA SMART SMALL FAMILY FARMS

To apply Precision Farming possibilities to SHF&FF it is now urgently necessary to overcome innovation gaps, as clearly explained in the report EDUC-V-31 of the EC that mention the following needed actions (Markkula 2013):

- supporting the targets to be achieved on competitiveness and innovation by 2020, especially through continued investment in education and training;
  - stressing the importance of balancing technological, design and social innovation in both the public and private sectors, all of which are influenced by far-reaching digitisation;
-

- striving for societal innovation, with living labs, testbeds and open innovation methods in regional innovation policy-making, while getting citizens on board;
- highlighting the role of a local and regional environment that supports the integration of higher education, research and business;
- implementing the Knowledge Triangle as a key principle in European university reform (greater synergies between research, education and innovation);
- underlining the key role of research infrastructure in knowledge-based innovation systems;
- focusing more on the active use of innovative public procurement, combined with simplification of procedures;
- stressing the importance of Europe-wide collaboration and transnational cooperation projects between regions, building on innovation support and smart specialisation strategies;
- highlighting the potential of cross-border cooperation, including inward investment to and outward investment from the EU;
- improving competences for innovation and fostering a new innovation mind-set built on dialogue, collaboration and co-creativity to learn from best practice.

In Tuscany we have applied and tested importance of these concepts in the MARS+ Transfrontalier Project (Cannizzo et al., 2012) as evidence of what was declared in the before mentioned EU report: Regions need new arenas as hotspots for innovation co-creation. These could be described as ‘innovation gardens’ and ‘challenge platforms’, which together form a prototype workspace for inventing the future. These are needed to address challenges - from small local challenges to major societal challenges at global level. RDI activity is therefore required that will pilot and create prototypes of (1) spatial configurations with physical, intellectual and virtual dimensions, and (2) orchestration and knowledge management toolkits needed to address challenges. There are exciting developments emerging in university laboratories around Europe, and even more globally, which tackle major societal and industrial challenges (Markkula 2013). However, the best laboratories for breakthrough innovations today are no longer traditional University facilities, but regional innovation ecosystems operating as test beds for rapid prototyping of many types of user-driven innovations, based on transformative and scalable systems. To transform science and technology research results into strong flows of new products, services, and processes, Europe needs to stimulate innovation in systems of production different from old-style manufacturing.

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## 5 REGIONAL SERVICE PLATFORMS

As previously described Precision Farming opportunities comprise a huge universe of techniques, technologies and related competencies.

Nowadays, new innovative Precision Farming techniques are currently applied only on isolated and not integrated cases; and as consequence, it is not possible to achieve an effective, sustainable, durable production processes. This required integration needs high investments in equipment, tools, logistics and services that are not economically sustainable from a single farm especially SHF and FF.

The mission of the Regional Service Platforms (RSP) is to develop an open system that will be instantiated into decision support systems dedicated to sustainable, smart agriculture. The technological RSP should be based on a cooperative multi-actor approach. The architecture should be fully open in order to easily integrate components developed over the years by 3<sup>rd</sup> parties including additional knowhow for prediction models, models for variable rate applications, data collection components, onboard and ground sensors and others. Particular attention should be paid to the capability of the platform to extract integrate and correlate data from multiple heterogeneous sources in order to provide the various models with data based on a common and normalized cloud data flow. This will allow the creation of Smart Agriculture Services Platforms at Regional level. Such Regional Platforms will on the one hand serve agri-food companies in order to optimize production and provide automatic tracking and certification of products, and on more it will be used by Regional Governments to obtain reports and data on the usage of resource and the status of the environment. Development of the Regional Platform should need different skills, ranging from end-users (farming companies) to research institutions to SMEs.

With these aims in mind, the developing AgriSmaRT includes organizations of many types (Research Centers, SMEs, Farmers and others) gathering multiple competences, spanning farmers, farm machinery and mechanization, earth observation using space technologies, satellite navigation and communications, airborne and UAV assets, Geographical Information Systems, model design and validation and many others.

- The non-profit Association ToscanaSpazio with regional SMEs is facilitating this process, as the application of space technologies to agriculture has been recently identified among one of the smart specialization clusters of the Tuscany Region.
-

- University and Research Centres support research, instruction and training, participating in the feedback process.
- Pilot Farms give evaluation of innovation in testbeds.

## 6 REMARKS

Family farming is important for the European Union because the majority of the EU's 12 million farms are family farms, passed down from one generation to another, and they greatly contribute to the socio-economic and environmental sustainability of rural areas. It is important to strive to support family farming due to the social benefit of strengthening family values, solidarity, continuity and commitment, while the economic benefit is that it improves entrepreneurial skills, strengthens business ownership, management and individual achievement. By supporting young people in promoting family farming, not only the agricultural sector, but society as a whole will benefit.

It is theoretically possible to narrow the innovation divide via Smart Small Family Farms. The following suggestions can play a role in achieving this goal:

- Dissemination events with interactive and participative approach (such as Mars+) and Life Long Learning.
  - Evaluation test beds in the virtuous pilot farms system
  - Regional technological platforms between Small Family Farms, Pilot Farms, SMEs, Services, RES...
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